REMARKS

Prior to examination on the merits, please amend the above-identified national phase application in the manners indicated in the enclosed substitute specification. Applicant submits that no new matter has been added through the amendments. The amendments relative to the translated international application are indicated in the attached machine generated redline specification.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: 8.11.2006

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BODY REINFORCEMENT DEVICE FOR A VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a National Phase application of International Application No. PCT/JP2005/001768, filed February 7, 2005, which claimed priority to Japanese Application No. 2004-036266, filed February 13, 2004, each of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

~~[Field of the Invention]~~

~~[0001]~~

~~——~~The present invention relates to a vehicle body reinforcement device ~~for a vehicle~~ for reinforcing a body when the device is mounted to the body such that two portions to be reinforced are connected to each other.

Description of the Related Art

~~——[Background Art]~~

~~[0002]~~

~~—~~Conventionally, a body of a motorcar has been formed such that a highest possible strength is effected while aiming at weight saving. In such ~~a kind of body~~bodies, a reinforcement member is mounted to a region where a greater strength is required compared with other regions, such as a section where a wheel suspension device is mounted~~, is mounted a reinforcement member~~. The reinforcement member is mounted in such a manner that two portions to be reinforced are connected to each other. As for such a reinforcement member, there has been known one formed in the shape of a rod by a rigid body or one in which damping force generating means is provided, for example, as shown in JP-A-2002-211437.

~~——[0003]~~

~~—~~The reinforcement member disclosed in ~~this patent publication~~JP-A-2002-211437 is formed in an elongated shape~~,~~ and damping force generating means is provided in its middle in the longitudinal direction. The damping force generating means can be ~~, such as~~ a

hydraulic damper or a rubber member. This reinforcement member spans the space between two portions to be reinforced of a body. In one use~~, that is~~, the reinforcement member can be mounted between a suspension mounting portion on the left side of the body and a suspension mounting portion on the right side thereof.

~~[Disclosure of the Invention]~~

~~[Problem to be Solved by the Invention]~~

~~[0004]~~

~~—~~The body of an automobile is some times subjected to elastic deformation in a direction in which the distance between the two portions to be reinforced is shortened or lengthened, such as ~~, or in a direction opposite to that, when an~~ during ~~abrupt~~ quick handling operations~~, for example, is performed during running~~. At this time, a load is also applied, in the direction of compression or the direction of elongation, to the reinforcement member connecting the portions to be reinforced to each other. If a reinforcement member formed only by a rigid body is used, the reinforcement member is subjected to elastic deformation in the direction of compression or the direction of elongation by athe load applied to the body when it is deformed, as described above.

~~[0005]~~

~~—~~This reinforcement member stretches or contracts by its own elasticity when it is released from the load or when~~and~~ the force causing the elastic deformation vanishes. The conventional rigid reinforcement member ~~made from a rigid body comes~~ begins to vibrate in the longitudinal direction ~~during abrupt handling operation~~ due to loading during quick handling operations because of ~~its~~ the member's longitudinal elongation and contraction. Therefore, while the vehicle body using this rigid reinforcement member ~~made from a rigid body~~ is less likely to be elastically deformed, it may provide unnecessary vibration in the reinforcement member.

~~[0006]~~

~~—~~Such a disadvantage can be ~~eliminated to some extent~~ reduced by using a reinforcement member having damping force generating means such as disclosed in JP-A-2002-211437. This is because vibration of the reinforcement member itself is damped by the damping force generating means.

—However, since the such damping reinforcement member provided with damping force generating means is has a decreased in its repulsion force when a under axial loading. Therefore is applied in the direction of compression or the direction of elongation, the capacity ability to suppress the deformation of the body was low is lower than that of a rigid compared with when a reinforcement member made from a rigid body is used.

[0007]

—In view of the foregoing, the object of this invention is to provide a body reinforcement device for a vehicle is desired that which is capable of can reliably suppressing deformation of a body and which doesn't reduces constitute a vibration generating sourcein the reinforcement device as well.

SUMMARY OF THE INVENTION

[Means for Solving the Problem]

[0008]

In order to achieve the foregoing objectAccordingly, the one configuration of a body reinforcement device for a vehicle that is arranged and configured in accordance with certain features, aspects and advantages of the present invention according to this invention is provided with a reinforcement member for rigidly connecting two portions to be reinforced of a vehicle body with each other, and the device is provided with a damping force generating means for generating viscous damping force spanning, along the reinforcement member, the space between the portions to be reinforced.

[Effect of the Invention]

[0009]

As described above, according to the invention of claim 1 to claim 3, aPreferably, a reinforcement member substantially functions as a beam and reinforces the vehicle body, when a load is applied, to the reinforcement member in the direction of compression or the direction of elongation, to the reinforcement member at each end. At this time, tWhen the reinforcement member is elastically deformed in the direction of compression or the direction of elongation by the load applied to the reinforcement member at each end, the reinforcement member stretches or contracts by its own elasticity and begins to vibrate when released from the load, so that it comes to vibrate in the longitudinal direction. However, since in the

~~reinforcement device according to this invention,~~ when combined with the damping force generating means ~~is provided~~ that also spans ~~across~~ the space between the two portions to be reinforced ~~where the reinforcement member is mounted~~, the displacement of the reinforcement member in the longitudinal direction is kept small by the damping force generating means, whereby the vibration is damped.

—Therefore, ~~according to this invention,~~ a body reinforcement device can be provided in which the deformation of a body can be suppressed reliably and ~~no~~ limited vibration, if any, is produced.

~~[0010]~~

—According to other features, aspects and advantages of certain embodiments of the invention ~~of claim 4~~, ~~one~~ the ends of the reinforcement member and the damping force generating means are attached to a mounting bracket and are rigidly connected to each other through the mounting bracket. Therefore, vibration of the reinforcement member can be transmitted directly from one end thereof to one end of the damping force generating means through the mounting bracket, and vibration can be dampened more reliably by the damping force generating means. In addition, ~~since~~ because the mounting bracket is mounted to the portion to be reinforced, ~~one~~ the ends of the reinforcement member and the damping force generating means can be mounted at ~~a~~ the same time to the portion to be reinforced. Therefore, this body reinforcement device can be mounted to the body more easily compared with when the reinforcement member and the damping force generating means are mounted separately to the body.

~~[0011]~~

—According to other features, aspects and advantages of certain embodiments of the invention ~~of claim 5~~, it is possible that one of the reinforcement member and the damping force generating means~~, only one member provided,~~ is located on the same axial line as an imaginary line connecting the two portions to be reinforced of the body while ~~, and~~ a plurality of members (e.g., the other of the reinforcement and damping components) are provided ~~are located~~ at positions generally symmetrical with respect to the imaginary line. In such a device,

~~Therefore, in the body reinforcement device according to this invention,~~ no moment due to a reaction force is produced when a load is applied from the portion to be reinforced of the body and the body can be reinforced more firmly when the reaction force is exerted in the longitudinal direction (along the imaginary line).

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will now be described with reference to the drawings of several preferred embodiments, which embodiments are intended to illustrate and not to limit the invention.

~~[Brief Description of the Drawings]~~

~~[0012]~~

—FIG. 1 is a plan view showing a body reinforcement device for a vehicle, which device is arranged and configured in accordance with certain features, aspects and advantages of the present invention ~~according to this invention~~.

—FIG. 2 is a perspective view showing the reinforcement device ~~according to the invention being~~ mounted to a vehicle body.

—FIG. 3A is a side view showing another embodiment.

—FIG. 3B is a plan view showing the ~~other~~ embodiment of FIG. 3A.

—FIG. 4 is a perspective view showing the reinforcement device ~~being~~ mounted to a body.

—FIG. 5A is a side view showing another embodiment.

—FIG. 5B is a plan view showing the ~~other~~ embodiment of FIG. 5A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The body reinforcement devices discussed herein can be used as a device for reinforcing bodies of the vehicles such as cars, trucks or buses. ~~[Best Mode for Carrying out the Invention]~~

~~[0013] (First Embodiment)~~

—Now, one embodiment of the body reinforcement device for a vehicle according to ~~this~~ certain features, aspects and advantages of the present invention will be described in detail with reference to FIG. 1 and FIG. 2.

~~FIG. 1 is a plan view showing the body reinforcement device for a vehicle according to this invention, and FIG. 2 is a perspective view showing the reinforcement device according to this invention being mounted to a vehicle body.~~

~~In these figures,~~ a reference numeral 1 denotes a reinforcement device assembly formed by using two body reinforcement devices ~~according to this embodiment~~arranged and configured in accordance with an embodiment having certain features, aspects and advantage of the present invention. The illustrated reinforcement device assembly 1, as shown in FIG. 2, is a device for reinforcing the portion in a chassis 3 of an automobile where a front wheel suspension device 4 is mounted.

~~[0014]~~

~~The~~ front wheel suspension device 4, as is conventionally well-known, ~~is constituted with~~ comprises a front suspension member 5 forming part of the chassis 3; a pair of left and right lower arms 6, 6 extending in a lateral direction ~~laterally~~ of the vehicle body from both ends of the front suspension member 5 in the lateral direction; a pair of left and right upper arms (not shown) connected to the ends of these lower arms 6, 6 through a knuckle (not shown); a cushion unit or shock absorber (not shown) provided between the swinging portion of one of both these arms and a body 3a of the chassis 3; and the like.

~~[0015]~~

~~The~~ front suspension member 5 preferably supports part of an ~~unillustrated~~ engine (not shown) and a forward pivot portion 7 of the lower arm 6. The front suspension member 5 can be ~~, and is~~ rubber-mounted or rigid-mounted to the body 3a of the chassis 3.

~~The~~ lower arm 6, as shown in FIG. 2, ~~is~~ can be supported by the forward pivot portion 7 and a rear pivot portion 8 (described later) for up and down swinging movement relative to the chassis 3. The rear pivot portion 8 ~~is~~ can be provided with an ~~unillustrated~~ inner cylinder (not shown), an outer cylinder 8a housing the inner cylinder ~~inside~~ and ~~having~~ comprising an arm body 6a of the lower arm 6 welded thereto. A ~~and a~~ cushion rubber (not shown) can be provided between the inner and outerse cylinders. The rear pivot portion 8 can be ~~, and is~~ mounted to a mounting seat 9 of~~provided on~~ the body 3a of the chassis 3 ~~in a projecting relation,~~ with a mounting bolt 10. In one configuration, the rear pivot portion 8 can project from the mounting seat 9 of the body 3a.

~~[0016]~~

~~—~~Mounting to the mounting seat 9 of the rear pivot portion 8 is performed by placing the rear pivot portion 8 on the mounting seat 9 with its axis pointing generally vertically and fastening the inner cylinder to the mounting seat 9 with the mounting bolt 10 inserted ~~in~~ through the inner cylinder. That is, with the rear pivot portion 8 mounted on the mounting seat 9, the cushion rubber is elastically deformed and the outer ~~pipe~~ cylinder 8a is displaced with respect to the inner ~~pipe~~cylinder, so that the arm body 6a ~~makes~~ is capable of making swinging movements.

~~[0017]~~

~~—~~The reinforcement device assembly 1 preferably is formed by two body reinforcement devices 2, 2 ~~being~~ that are combined in the shape of a letter V in plan view so that the chassis 3 can be reinforced by the connection of the laterally central portion of the front suspension member 6 and the left and right mounting seats 9.

~~—~~The body reinforcement device 2, as shown in FIG. 1, ~~is constituted with~~can comprise a rod 11 and a hydraulic damper 12. The rod 11 can be formed by one metallic round bar while the ~~, a~~ hydraulic damper 12 can be disposed alongside the rod 11 ~~side by side~~ to be generally parallel to the rod 11. A ~~, a~~ first mounting bracket 13 can connect~~ing~~ one ends of ~~both~~ each of these members 11, 12 to each other (see, e.g., left side ends in FIG. 1) and a second mounting bracket 14 can connect~~ing~~ the ~~other~~ ends of ~~both~~ each of these members 11, 12 to each other. In the illustrated~~is~~ embodiment, the rod 11 ~~constitutes~~ comprises the reinforcement member ~~referred to in this invention,~~ and the hydraulic damper 12 ~~constitutes~~ comprises the damping force generating means ~~referred to in this invention.~~ Other configurations of each of the reinforcement member and the damping force generating means also can be used.

~~[0018]~~

~~—~~The first mounting bracket 13 according to this embodiment ~~is~~ can be formed larger~~large sized compared~~ than ~~with~~ the second mounting bracket 14. The first mounting bracket 13 ~~, to which~~ is attached to one ends of the two reinforcement devices ~~are attached~~. The first mounting bracket 13 can be ~~, and is~~ fixed with two bolts 15, 15, or other suitable fasteners, to the portion of the body to be reinforced ~~of the body with two fixing bolts 15, 15~~.

In the illustrated configuration, "~~T~~the portion of the vehicle body to be reinforced ~~of the vehicle body~~ to which this first mounting bracket 13 is mounted", refers to the laterally central portion of the front suspension member 6.

~~[0019]~~

The rod 11 of ~~each of~~ the ~~foregoing two~~ reinforcement devices 2 ~~is~~ can be made from a hollow round bar that has ~~formed such that its~~ a thicker central portion ~~is thicker than~~ relative to each end. The end ~~, and to the other end~~ of the rod 11 opposite the first mounting bracket 13 can be~~are~~ welded to a coupling boss 16 and a second mounting bracket 14.

In one configuration, ~~C~~connection of one end of the rod 11 to the mounting bracket 13 ~~is~~ can be performed ~~thorough~~by inserting one end of the rod 11 into ~~the~~ a mounting hole 13a formed in the first mounting bracket 13 and then welding the end of the rod 11 to the opening of the mounting hole 13a. The mounting hole 13a ~~is~~can be ~~formed~~ inclined such that its axis is located gradually outwardly of the body toward the rear of the body (i.e., rightward in FIG. 1) in order that the two rods 11 are attached to the first mounting bracket 13 in the shape of a letter V in plan view.

~~[0020]~~

The other end of the rod 11 ~~according to this embodiment is fixed~~ can be secured to the portion of the body to be reinforced ~~of the body~~ together with the second mounting bracket 14 ~~with~~ by the mounting bolt 10. In the illustrated embodiment, ~~T~~"the portion to be reinforced" refers to the mounting seat 9 to which the rear pivot portion 8 of the lower arm 2 is mounted, as shown in FIG. 2. That is, the mounting bolt 10 fastens the rear pivot portion and second mounting bracket 14 together.

The rod 11 according to this embodiment, as shown in FIG. 2, preferably is connected to the rod 11 of the other reinforcement device 2 through a cross member 17.

~~[0021]~~

The hydraulic damper 12 ~~is constituted with~~can comprise a cylinder 21, a piston rod 22 ~~mounted detachably~~moveably mounted to the cylinder 21, a free piston 23 fitted for movement in the cylinder 21 ~~on the~~ opposite ~~side from~~ to the piston rod 22, a piston 24 with a ~~choke~~ throttle ~~fixed~~ secured to the piston rod 22 at its end, a compression coil spring 25 for

biasing the piston ~~with a choke~~ toward the free piston 23~~in the opposite direction from the piston rod 22~~, and the like.

~~[0022]~~

~~—~~The cylinder 21 ~~is~~ can be provided, at its end on the opposite side from the piston rod 22, with a boss 12a, and ~~is~~ can be secured ~~fixed~~ to a mounting ~~metal~~ plate 26a ~~through~~ by the boss 12a and a fixing bolt 26. The mounting ~~metal~~ plate 26a ~~is~~ can be secured~~fixed~~ to the first mounting bracket 13 with a ~~fixing~~ bolt 15 used to secure ~~for fixing~~ the first mounting bracket 13 to the front suspension member 5. The mounting ~~metal~~ plate 26a may be welded to the first mounting bracket 13.

~~[0023]~~

~~—~~The interior of the cylinder 21 ~~is~~ can be divided by the free piston 23 into a high pressure gas chamber 27 and an oil chamber 28. The oil chamber 28 ~~is~~ can be divided by the piston 24 ~~with a choke~~ into a first oil chamber 29 located on the piston rod 22 side and a second oil chamber 30 located on the free piston 23 side. The two oil chambers 29, 30 communicate through the throttle (not shown) that extends through the piston 24. The high pressure gas chamber 27 ~~is~~ can be filled with N2 gas at a high pressure and the first and second oil chambers 28, 29 ~~are~~ can be filled with working oil.

~~[0024]~~

~~—~~The piston rod 22 is provided, at its end on the opposite side from the cylinder 21, with a boss 12b, and a mounting ~~metal~~ plate 32 ~~is~~ can be ~~fixed~~ secured ~~through~~ to the boss 12b ~~and~~ with the ~~fixing~~ bolt 31. The mounting ~~metal~~ plate 32 ~~is fixed~~ can be secured to the second mounting bracket 14 with a ~~fixing~~ bolt 33. The mounting ~~metal~~ plate 32 may be welded to the second mounting bracket 14 in some configurations.

~~[0025]~~

~~—~~The piston 24 with ~~a choke~~ the throttle can be mounted to the piston rod 22 and can be ~~is~~ provided with a ~~choke~~ throttle (not shown) that defines a passage ~~for the communication~~ between the first oil chamber 29 and the second oil chamber 30. That is, the hydraulic damper 12 is configured such that the damping force (viscous damping force) is produced when working oil flows through the ~~choke~~ throttle from the first oil chamber 29 into the second oil chamber or from the second oil chamber 30 into the first oil chamber 29.

~~[0026]~~

—The compression coil spring 25 is provided between the piston 24 ~~with a choke~~ and a piston rod-side cover 21a of the cylinder 21. The spring force of the compression coil spring 25 ~~is~~ can be set to ~~a value as large as that counterbalancing~~ ounterbalance the gas pressure in the high pressure gas chamber 27. That is, the free piston 23 ~~pushes~~ is urged against the working oil in the second oil chamber 30 through gas pressure in the high pressure gas chamber 27. However, the throttled piston 24 ~~with a choke~~ is maintained in a generally neutral position ~~without changing its position~~ when biased by the spring force of the compression spring 25.

~~[0027]~~

—In addition, in some configurations, the compression coil spring 25 ~~is~~ can be formed ~~of by~~ a shape-memory alloy or a bimetal. In other configuration, a majority of the spring 25 is formed of such materials ~~approximately in whole~~. In forming the compression coil spring 25 from such a material, it preferably is arranged such that when the temperature of the compression coil spring 25 is raised (or lowered), its free length in the axial direction of the cylinder 21 is extended (or shortened) ~~according to the characteristics~~ to thereby increase (or decrease) the foregoing biasing force.

~~[0028]~~

—As a result of adopting such an arrangement, in the illustrated hydraulic damper 12, even if the temperature of the hydraulic damper 12 is raised by the engine heat and the gas pressure in the high pressure gas chamber 27 is increased, the piston 24 ~~with a choke~~ can be retained in a generally neutral position. This is because in the illustrated hydraulic damper 12, the spring force of the compression coil spring 25 for biasing the piston 24 ~~with a choke~~ ~~is~~ also is increased by the temperature rise. Therefore, no load is applied to the two portions to be reinforced of the body from the reinforcement device 2 as a result of the temperature change. The free piston 23 moves in the axial direction by the distance corresponding to the amount of volumetric change ~~of~~ caused by movement of the piston rod 22 into or out of the cylinder 21.

~~[0029]~~

—The hydraulic damper 12 ~~formed as described above,~~ preferably is attached to the first mounting bracket 13 and the second mounting bracket 14 such that its axis is generally parallel to the axis of the rod 11. In forming the reinforcement device assembly 1 by combining two reinforcement devices 2 in the shape of a letter V in a plan view as in the illustrated~~is~~ embodiment, the hydraulic damper 12 is positioned adjacent to and at the outer side of the rod 11 in the lateral direction of the vehicle body in relation to the connection of both the rods 11, 11 and the cross member 17.

~~[0030]~~

—The body reinforcement device 2 ~~arranged as described above,~~ preferably is mounted to a vehicle body~~,~~ with the first mounting bracket 13 fixed to the laterally central portion of the suspension member 14 and with the second mounting bracket 14 fixed to the rear pivot portion 8 of the lower arm 7. As a result of the reinforcement device 2 mounted to the vehicle body in this way, the two portions to be reinforced (suspension member 14 and rear pivot portion 8) of the body are connected to each other rigidly by the rod 11.

~~[0031]~~

—Therefore, in the illustrated body reinforcement device 2, when the body (chassis 3) is elastically deformed ~~due to abrupt handling operation, for example,~~ and a load is applied at each end in the direction of compression or the direction of elongation, the rod 11 substantially functions as a beam to thereby reinforce the body. As a result, provision of the reinforcement device 2 enables the deformation of the body to be kept small.

—When the body reinforcement device 2 suppresses the elastic deformation of the body, the rod 11 is elastically deformed in the direction of compression or the direction of elongation, with a load applied at each end, and stretches or contracts by its own elasticity. Therefore, the rod 11 ~~comes~~ attempts to vibrate in the longitudinal direction at this time.

~~[0032]~~

—However, ~~since~~ because, in the illustrated~~is~~ reinforcement device 2, the hydraulic damper 12 is connected to the rod 11 through the first mounting bracket 13 and second mounting bracket 14 and damping force is produced by the hydraulic damper 12 if the rod 11 vibrates in the longitudinal direction, the vibration of the rod 11 is dampened by the hydraulic

damper 12. That is, in the chassis 3 reinforced by the body reinforcement device 2, little to no vibratione is produced by because of the rod 11 constituting a vibration generating source.

—Therefore, the illustrated body reinforcement device 2 is able to reduce keep the deformation of the body small while also reducing keeping the vibration of the rod 11 small.

[0033]

—In addition, in the body reinforcement device 2 according the this illustrated embodiment, one the corresponding ends of the rod 11 and hydraulic damper 12 are connected to each other rigidly through the first mounting bracket 13 while the other ends of the rod 11 and hydraulic damper 12 are connected to each other rigidly through and the second mounting bracket 14. Therefore, in this the illustrated body reinforcement device 2, vibration of the rod 11 can be transmitted directly to the hydraulic damper 12 through the first mounting bracket 13 and second mounting bracket 14. As a result, in the illustrated this body reinforcement device 2, the vibration of the rod 11 can be better damped even more reliably by the hydraulic damper 12.

[0034]

—Further, since the corresponding ends of the rod 11 and hydraulic damper 12 are attached to one mounting bracket 13, 14, the ends of the rod 11 and hydraulic damper 12 can be mounted to the portion to be reinforced at a the same time. As a result, mounting work of the reinforcement device 2 can be performed easily mounted in position. Since Because in this embodiment, one first mounting bracket 13 is used in common for the body reinforcement device 2 on the left side of the body and the body reinforcement device 2 on the right side of the body, the illustrated reinforcement device assembly 1 having two reinforcement devices 2 can be mounted to the body easily. Further, as a result of adopting the foregoing arrangement, higher strength can be achieved compared with when the body reinforcement device 2 on the left side of the body and the body reinforcement device 2 on the right side of the body are mounted separately at the foregoing same positions.

Another embodiment of [0035] (Second Embodiment)

—Tthe body reinforcement device for a vehicle according to this invention can be formed as shown in FIG 3A, FIG. 3B and FIG. 4.

—FIG. 3A is a side view ~~showing~~ of this ~~another~~ embodiment, and FIG. 3B is a plan view showing ~~the other~~ this embodiment. FIG. 4 is a perspective view showing the reinforcement device ~~being~~ mounted to a body. In these figures, the same or similar parts as those described in FIG. 1 and FIG. 2 are designated by like reference numerals and detailed description is not repeated.

~~[0036]~~

—A body reinforcement device 40 shown in FIG. 3A, FIG. 3B and FIG. 4 ~~is constituted with one~~ comprises a hydraulic damper 12, ~~two~~ one band ~~bands~~ 41, ~~41~~ located on ~~both~~ each sides of the hydraulic damper 12 and first and second mounting brackets 42, 43 for connecting ends of these hydraulic damper 12 and bands 41, 41 to each other. The hydraulic damper 12 preferably has the same structure as that used in the first embodiment. In this embodiment, the bands 41 constitutes the reinforcement member ~~referred to in this invention~~.

Each of ~~[0037]~~

—~~T~~the bands 41 ~~is~~ can be made from a steel plate formed in the shape of a narrow band and each of the bands can be ~~at both ends are~~ fixed at both ends to the first and second mounting brackets 42, 43 with fixing bolts 44. The bands 41 may be welded to the first and second mounting brackets 42, 43 in some configurations. Other suitable techniques also can be used.

Each of t~~The~~ first and second mounting brackets 42, 43 ~~are each constituted~~ comprises ~~by~~ a bracket body 45 that can be formed in the shape of a letter C in section. Each of the first and second mounting brackets 42, 43 also can comprise ~~and~~ a mounting piece 46 having one end inserted in the inner side of the bracket body 45 and welded thereto. In one configuration, ~~T~~the mounting piece 46 ~~has~~ comprises a ~~bolt~~ hole 46a ~~drilled~~ positioned at the laterally central portion (in the direction in which the bands 41 are disposed side by side). The hole 46a can be formed in any suitable manner, including but not limited to drilling.

~~[0038]~~

—The illustrated bracket body 45, inside of which a boss 12a, 12b is ~~fitted~~ positioned and at both outer sides of which the bands 41 are overlapped, ~~is~~ can be secured ~~fixed~~ to the bands 41 and the hydraulic damper 12 with a ~~fixing~~ bolt 44 ~~passing~~ that extends through these parts.

—Since Because the first and second mounting brackets 42, 43 of the illustrated configuration are attached to the bands 41 and hydraulic damper 12 in this waymanner, the body reinforcement device 40 is formed, with the bands 41 disposed substantially parallel to each other on both sides of the hydraulic damper 12.

[0039]

—The body reinforcement device 40, as shown in of FIG. 4, spans the space between two portions to be reinforced because of the mounting pieces 46, 46 at both ends being are mounted on a mounting portion 48 in of a rear wheel suspension device 47. The rear wheel suspension device 47 of the automobile is configured to be mounted to the chassis 3 and on the bottom surface 3 located near the mounting portion 48.

[0040]

–In the body reinforcement device 40 according to this embodiment, the hydraulic damper 12 can be located on the same axis as an imaginary line L (see FIG. 3(b)) connecting the two portions to be reinforced (mounting portion 48 and bottom surface of the chassis 3). Further, in this body reinforcement device 40, the two bands 41, 41 can be located at positions symmetrical positions with respect to the imaginary line L. Other suitable configurations also can be used.

[0041]

—Therefore, since in the body reinforcement device 40 according to this embodiment, because a load applied from the portion to be reinforced is can be distributed generally uniformly to the two bands 41, 41 of the illustrated configuration and because the load acts on the hydraulic damper 12 in its axial direction, no or virtually no moment due to a reaction force is produced when the load is applied, and the reaction force is allowed to act in the longitudinal direction (in the direction along the imaginary line L) for the firm reinforcement of the body.

Another embodiment of t [0042] (Third Embodiment)

—The body reinforcement device for a vehicle according to this invention can be formed as shown in FIG 5A and FIG. 5B.

—FIG. 5A is a side view showing another embodiment and, FIG. 5B is a plan view showing the other embodiment, and FIG. 5 B is depicted with a portion broken away. This

device can be mounted in the same manner as the embodiment of FIG. 3A and 3B, which is show in FIG. 4. ~~is a perspective view showing the reinforcement device being mounted to a body.~~ In ~~these figures~~FIG. 5A and FIG. 5B, the same or similar parts as described in FIG. 1 to FIG. 4 are designated by like reference numerals and detailed description is not repeated.

~~[0043]~~

~~A~~ The body reinforcement device 50 shown in FIG. 5A and FIG. 5B is provided, as damping force generating means for generating viscous damping force, with a ~~visco elastic~~viscoelastic member 51 made of rubber. The ~~visco-elastic~~viscoelastic member 51 ~~is~~ can be formed in the shape of a band extending substantially parallel to a band plate 41 and ~~is~~ can be coupled to the band plate 41 while being held between a pair of supporting bars 52, 53.

~~[0044]~~

~~—~~The supporting bars 52, 53 ~~are~~ can be formed by a metallic material or any other suitable material. The supporting bars 52, 53 can comprise ~~and is constituted by~~ plate-like portions 52a, 53a that extend~~ing~~ in the longitudinal direction of the band plate 41 along the main surface of the ~~visco-elastic~~viscoelastic member 51, and the supporting bars 52, 53 can also comprise bosses 52b, 53b fixed~~, together~~ with the bond plates 41~~,~~ to bracket bodies 45 with ~~fixing~~ bolts 44. Other suitable techniques also can be used. One main surface of the ~~visco-elastic~~viscoelastic member 51 preferably is fixed to the plate-like portion 52a of one supporting bar 52 and the other main surface of the ~~visco-elastic~~viscoelastic member 51 preferably is fixed to the plate-like portion 53a of the other supporting bar 53.

~~[0045]~~

~~—~~The boss 52b of one supporting bar 52 of these supporting bars 52, 53 ~~is~~ can be attached to a first mounting bracket 42 at one end of the body reinforcement device 50 and the boss 53b of the other supporting bar 53 ~~is~~ can be attached to a second mounting bracket 43 at the other end of the body reinforcement device 50.

~~—~~The plate-like portions 52a~~, and the plate-like portion~~ 53a, as shown in FIG. 5B, preferably are located at positions offset to ~~one side and to the other~~ opposing sides ~~with respect to~~ of the imaginary line L and also preferably are located at positions that are symmetrical with respect to the imaginary line L~~,~~ when supporting the ~~visco~~

~~elastic~~viscoelastic member 51~~,~~ with the imaginary line L passing ~~its~~ through substantially the center of the viscoelastic member 51.

~~[0046]~~

~~—~~In the body reinforcement device 50 arranged as described above, the band 41 substantially functions as a beam to reinforce the vehicle body, and when the band 41 vibrates in the longitudinal direction, the ~~visco-elastic~~viscoelastic member 51 is elastically deformed in the direction of its surface to thereby produce damping force. As a result, ~~no~~ the chassis 3 reinforced by the body reinforcement device 50 ~~vibrates~~ is less likely to vibrate substantially~~because of the band 41 becoming a vibration generating source~~. Therefore, the body reinforcement device 50 is able to keep the deformation of the vehicle body small while keeping the vibration of the band 41 small.

~~[0047]~~

~~—~~Although in the foregoing first through third embodiments, examples are shown in which both ends of the rod 11 or the band 41 and both ends of the hydraulic damper 12, or the ends of the supporting bars 52, 53, are attached to the first or the second mounting brackets 13, 14, 42, 43, these mounting brackets may be attached only to one ends of the reinforcement devices 2, 40, 50. In adopting such an arrangement, at the other ends of the reinforcement devices 2, 40, both of the rod 11 or the band 41 and the hydraulic damper 12 ~~are~~ can be mounted directly to the portion to be reinforced of the body. In adopting such an arrangement, at the other end of the body reinforcement device 50, the band 41 and the member of the supporting bars 52, 53 on the ~~side of the other~~ opposite end ~~are~~ can be mounted directly to the mounting portion of the vehicle body. Although mounting man-hours are increased, an arrangement may be adopted in which both ends of the rod 11 or the band 41, both ends of the hydraulic damper 12 and the ends of the supporting bars 52, 53 are mounted directly to the portion to be reinforced of the vehicle body separately, in which case as in the foregoing embodiment, the body can be reinforced while preventing generation of the vibration.

~~[0048]~~

~~—~~In addition, although in the second and the third embodiment~~,~~ examples are shown in which bands 41 are disposed at the sides of the damping force generating means (hydraulic

damper 12, ~~visco-elastic~~viscoelastic member 51), ~~this invention is not limited to that, but~~ the damping force generating means may be disposed on both sides of one reinforcement member (rod 11 or band 41). Further, although in the second and the third embodiment~~,~~ examples are shown in which the plate-like band 41 is used, a bar-like reinforcement member may be used as shown in the first embodiment. Furthermore, the reinforcement device ~~according to this invention~~ may be arranged such that the reinforcement devices 40, 50 shown in the second or the third embodiment are connected in series. In arranging these members in series, bars 11 ~~are~~ can be welded to the reinforcement device 40, 50 at both ends such that they are located on the same axial line, respectively. Such a configuration, however, is less desirable than the parallel configurations described herein.

~~[0049]~~

~~—~~Further, although the foregoing embodiments, examples of which ~~are shown in which portions where~~ reinforce the front wheel suspension device 4 or the rear wheel suspension device 47 ~~is mounted to the chassis 3, is reinforced by the body reinforcement device 2, 40, 50 according to this invention~~, the reinforcement device ~~according to this invention~~ may be used for reinforcing ~~the~~ other ~~part~~ portions of the vehicle ~~of the~~ body. For example, the reinforcement device ~~according to this invention~~ may be provided in an automobile with an engine mounted at the front of the vehicle body such that it crosses an opening of the engine room in the upper part in the lateral direction. In adopting this arrangement, a reinforcement device may be used which is formed by the rods 11 being arranged in series at both ends of the reinforcement device 40, 50 shown in the second or the third embodiment and welded thereto, for example.

Although the present invention has been described in terms of a certain embodiment, other embodiments apparent to those of ordinary skill in the art also are within the scope of this invention. Thus, various changes and modifications may be made without departing from the spirit and scope of the invention. For instance, various components may be repositioned as desired. Moreover, not all of the features, aspects and advantages are necessarily required to practice the present invention. Accordingly, the scope of the present invention is intended to be defined only by the claims that follow.

~~[Industrial Applicability]~~

~~[0050]~~

~~The body reinforcement device according to this invention can be used as a device for reinforcing bodies of the vehicles such as cars, trucks or buses.~~

~~[Document Name] Abstract~~

WHAT IS CLAIMED IS:

1. A body reinforcement device for a vehicle comprising a rigid reinforcement member ~~for rigidly~~ connecting two portions ~~to be reinforced~~ of a vehicle body to each other and a damping force ~~generating means~~ member connecting the two portions of the vehicle body such that both the rigid reinforcement member and the damping force member ~~for generating viscous damping force~~ generally span the space between the two portions of the vehicle body~~spanning, along the reinforcement member, the space between the portions to be reinforced~~.

2. ~~[Claim 2]~~ The body reinforcement device for a vehicle as claimed in claim 1, wherein the damping force ~~generating means is~~ member comprises a hydraulic damper.

3. ~~[Claim 3]~~ The body reinforcement device for a vehicle as claimed in claim 1, wherein the damping force ~~generating means~~ member comprises ~~is~~ a rubber ~~visco elastic~~viscoelastic member ~~made of rubber~~.

4. ~~[Claim 4]~~ The body reinforcement device for a vehicle as claimed in claim 1, wherein the rigid reinforcement member comprises a first end and a second end, the damping force member comprises a first end and a second end, and ~~at least one ends of~~ the rigid ~~the~~ reinforcement member first end and the damping force ~~generating~~ member first end collectively are ~~means are~~ fixed to ~~the~~ one of the two portions of the vehicle body ~~to be reinforced through~~ by one mounting bracket.

5. ~~[Claim 5]~~ The body reinforcement device for a vehicle as claimed in claim 1, wherein the rigid reinforcement member and the damping force member ~~a plurality of members each being at least either one of the reinforcement member and the damping force generating means are formed and~~ are disposed side by side in a parallel orientation to each other.

6. The body reinforcement device for a vehicle as claimed in claim 5, wherein the rigid reinforcement member comprises a first member and a second member, the first and second members being disposed side by side to the damping force member ~~at the sides of the other member~~.

BODY REINFORCEMENT DEVICE FOR A VEHICLE

ABSTRACT OF THE DISCLOSURE

~~[Abstract] The present invention is provide~~ A body reinforcement device comprises ~~with~~ a rigid reinforcement member that connects ~~rod (11) for rigidly connecting~~ two vehicle body portions to be reinforced ~~of a vehicle body to each other~~. The body reinforcement device also comprises ~~The present invention is also provided with~~ a ~~hydraulic damper (12)~~ damping force member that ~~spanning~~spans the space between the two vehicle body portions. The rigid reinforcement member and the damping force member preferably extend generally parallel to each other~~, parallel to the rod (11), the space between the portions to be reinforced.~~.

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